



Quality Environmental Professional Associates

Scientific Analysis and Health Impact of Propane Levels in:

Ambient Air Data of Erie Colorado

Presented By :

NOAA Earth System Research Laboratory

February 21, 2012 Town of Erie Study Session



Task

1. A scientific analysis of the data presented by Dr. Steven Brown on February 21st
2. Assessing whether the levels of propane presented by Dr. Brown would present health concerns to the residents of Erie

Approach



- **Critical review of data**
- **Available human health guidelines**
 - Review of Federal Regulatory Agency documents
 - Limited literature review

Critical Review - Approach



- Focus on weaknesses of data
- Quality and context of the data

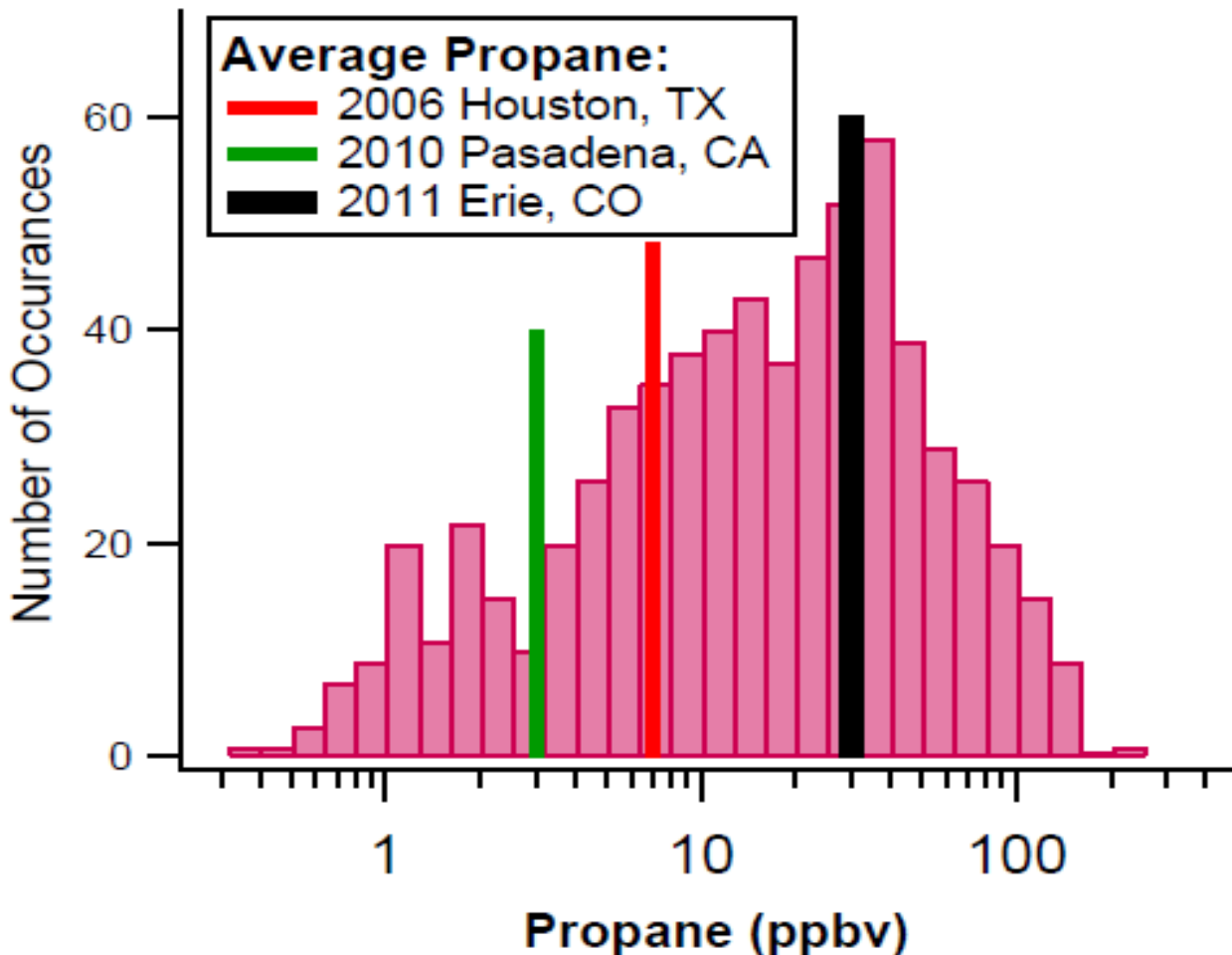


Photos: Rolf Sander

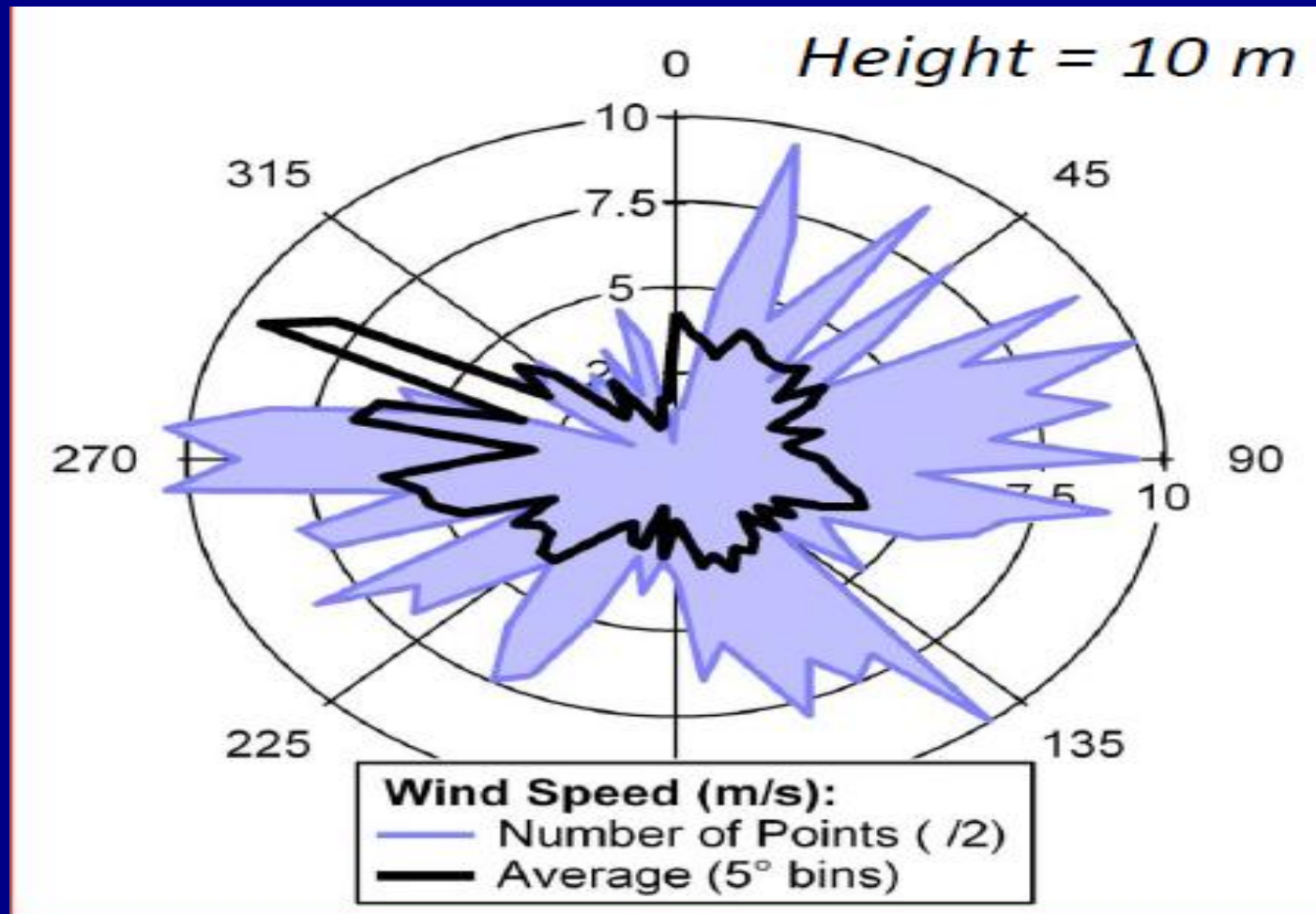
NOAA Study Summary

- Large source of alkanes from local natural gas operations
 - ethane and **propane**
 - Averages over 10 ppb with maximums over 100 ppb
- VOC oxidation appears to be minimal
 - Decreased production of secondary by-products such as ozone

NOAA Study Results



NOAA Study – wind rose





Critical Review - Results

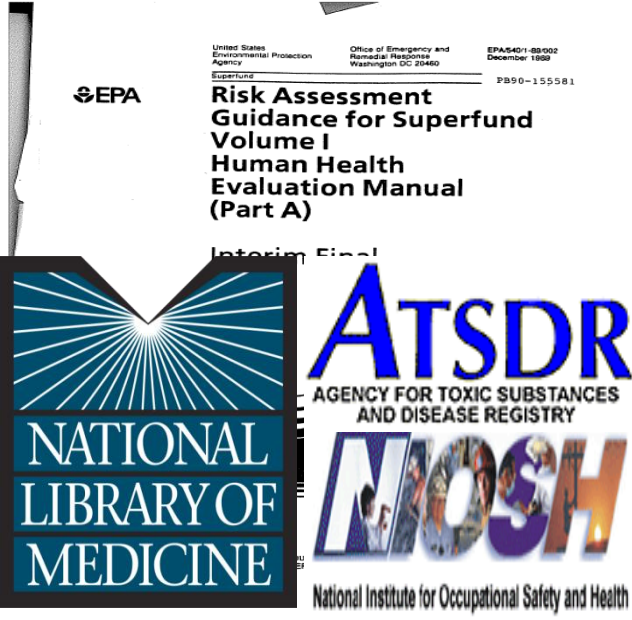
- Small seasonal sampling period
- Limited data set
- Wind direction not accounted for
- Data is not statistically reviewed
- The emissions inventory has not been correlated with the air data



Conclusions – Analysis of data

- Results should have been qualified as preliminary or limited and are not reliable for determining sources of the VOCs including propane
- A statistical evaluation of the data is needed for accurate portrayal of conclusions

Human Health Guidelines - Approach



- Search Federal data bases
 - Standards
 - Studies
- Assess impacts of propane levels presented on human health

Toxicology Premise

The right dose differentiates a poison from a remedy.



*"It is the dose that
makes the poison"*
Paracelsus



Propane

- Heavier than air
- Asphyxiant

Human Health Guidelines - Results

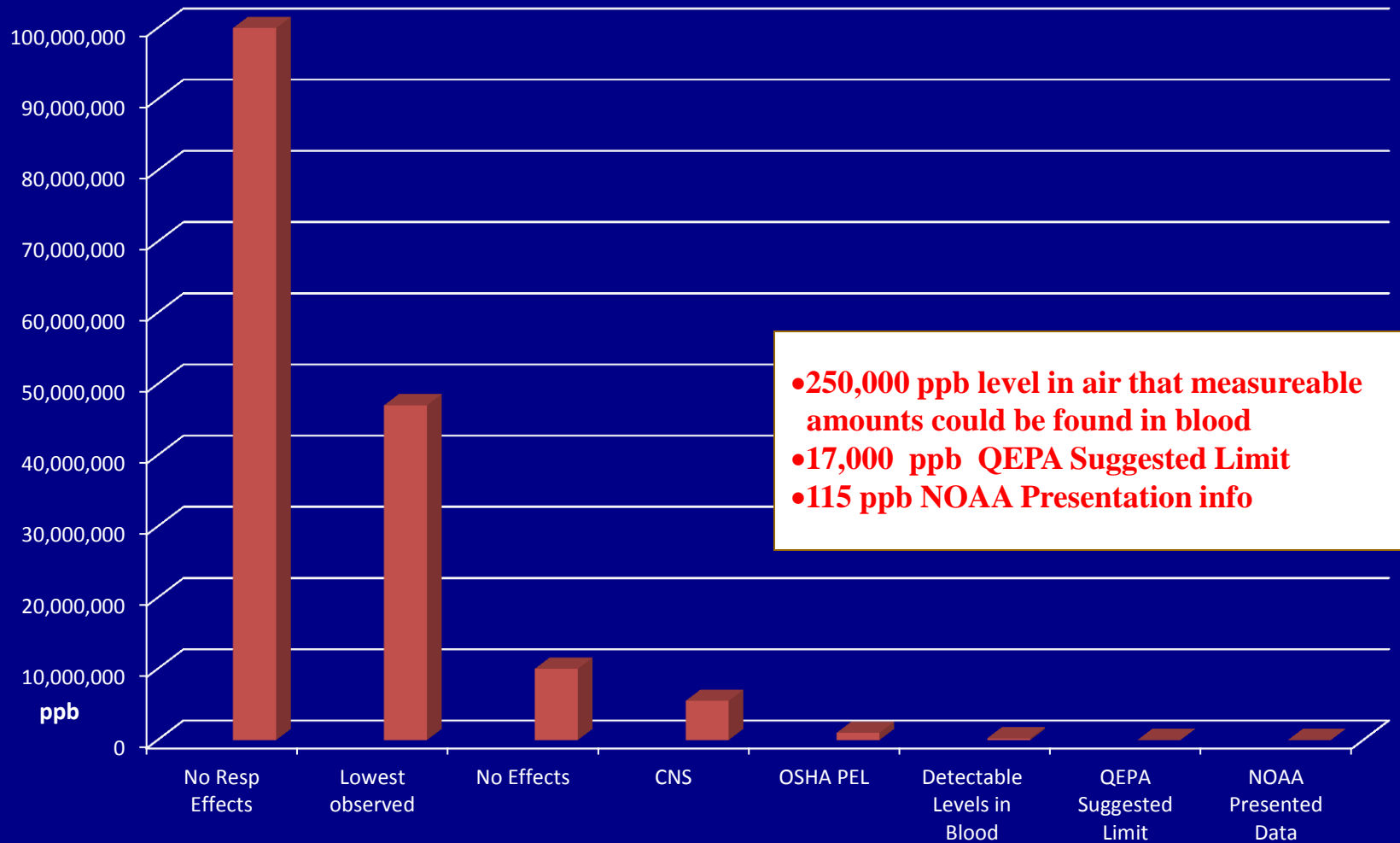
- Occupational Health guidelines only
- Two types of human studies found
 - Accidental exposure in enclosed environment
 - Accidental overdose
- No studies of ambient air poisonings
- Levels presented by NOAA are 1000 – fold or more below a level of concern



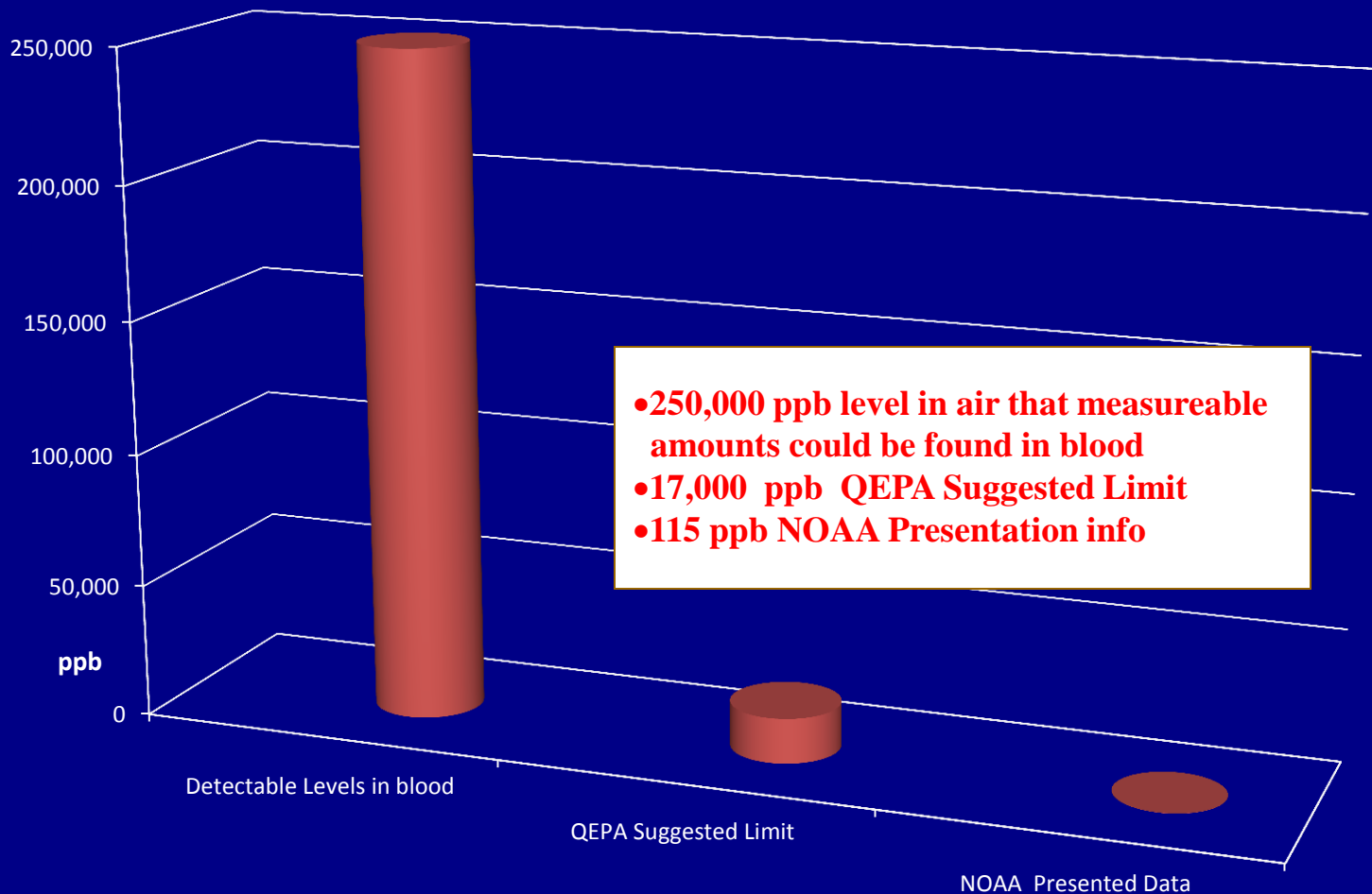
Community Health Concerns

- Town of Erie Study Session
- Erie Rising Public Forum
 - Endocrine Disruption
 - Diabetes
 - Asthma

Health Guidelines - Propane



Health Guidelines - Propane





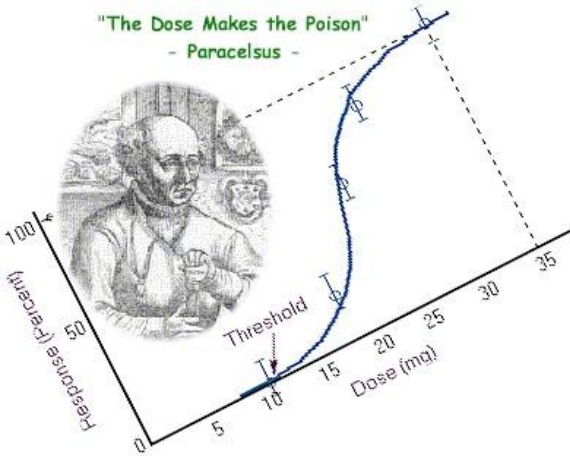
Conclusions – Human Health

- Inhalation is the primary route of exposure
- Occupational guideline of 1,000, 000 ppb
- Community Concerns
- QEPA suggested limit 17,000 ppb
- Propane at 115 ppb does not present a health concern.

Recommendations



- Use sound scientific data
- Application of proper statistical principles to evaluate the data
- Consider human perception
- Provide clear messaging



Everything is a Poison.....

It is important to understand
how and when something
can cause harm
so that informed decisions can be made

Health Guidelines Table

Level (ppb)	Designation	Effect occurring or being prevented	Source	Type	Duration
100,000,000	LOAEL Lowest Observed Adverse Effect Level	Vertigo	HSDB, NAS	Human	Acute
47,000,000	LAEL (modeled) Lowest Adverse Effect Level	Vertigo	HSDB	Human	Acute
23,000,000	Lower Explosive Limit	Explosion	NAS	Worker	Acute
17,000,000	AEGL-2 10 minutes AEGL-2 8-hours	Cardiac sensitization	NAS		Acute
10,000,000	NOAEL	Vertigo & CNS Depression	NAS		Acute
10,000,000	AEGL-1 10-minute	CNS Depression	NAS		Acute
5,500,000	AEGL-1 8-hour	CNS Depression	NAS		Acute
1,000,000	OSHA PEL 8-Hour Limit ACGIH TLV 8-Hour Limit NIOSH REL 10-Hour Limit	CNS Depression	OSHA ACGIH NIOSH	Worker	Chronic 45 yrs
17,000	QEPA's Estimate of an Suggested Ambient Air Limit for 24-hours per day	CNS Depression & Vertigo	QEPA	Citizen	Chronic 70 yrs
115	Maximum reported in NOAA 2011 Presentation		Dr. Brown		
20	Average in NOAA 2011 Presentation				

Margin of Safety Approach

$$\text{OEL (mg/m}^3\text{)} = \frac{(\text{NOAEL}) \times (\text{BW})}{(\text{UF}_C) (\text{MF}) (\text{V}) (\text{S}) (\alpha)}$$

where:

NOAEL = no-observed-adverse-effect level (mg/kg)

BW = body weight (kg)

UF_C = uncertainty factor (composite)

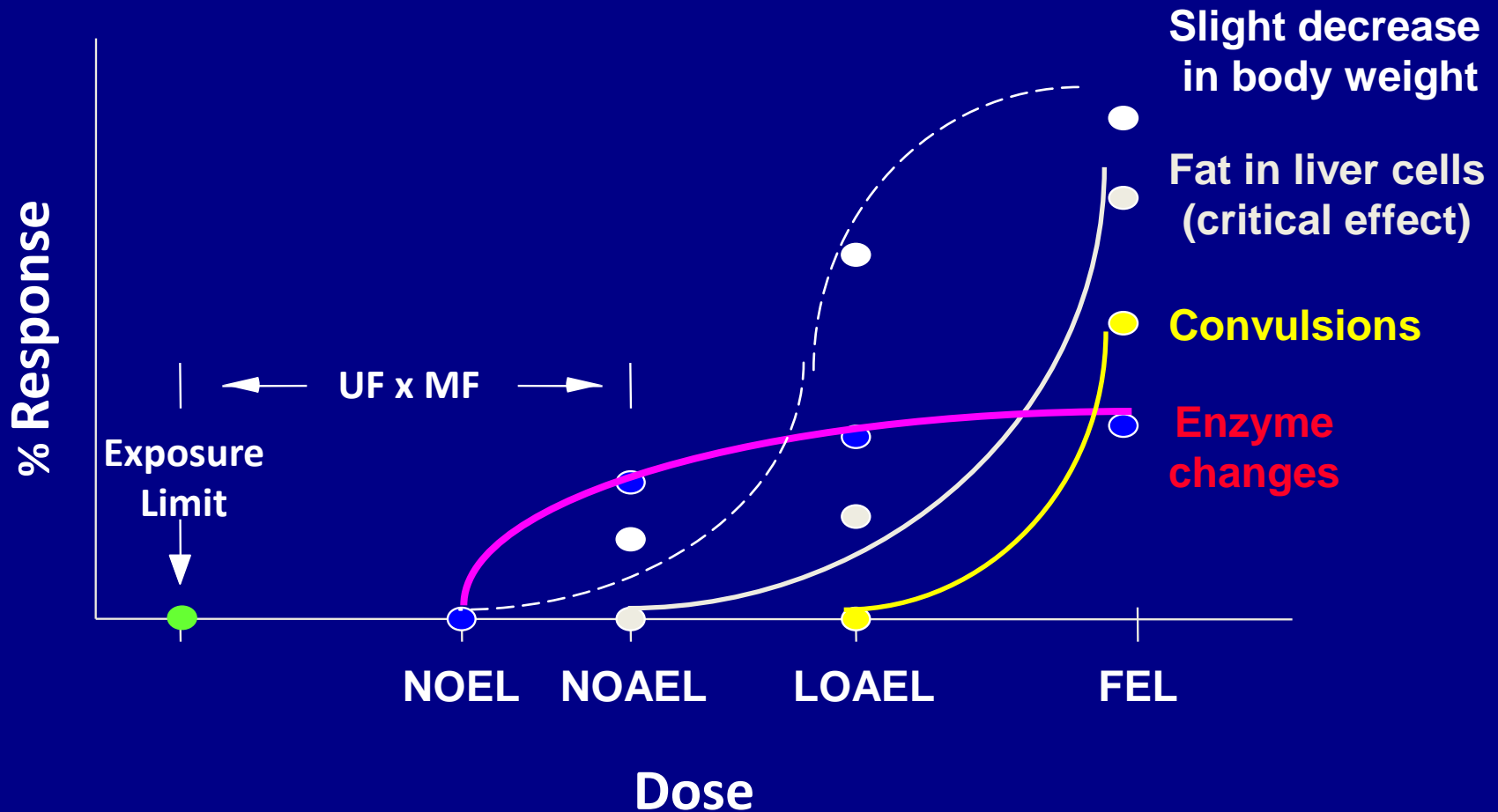
MF = modifying factor (professional judgment)

V = volume of air breathed by a worker in eight hours (m³)

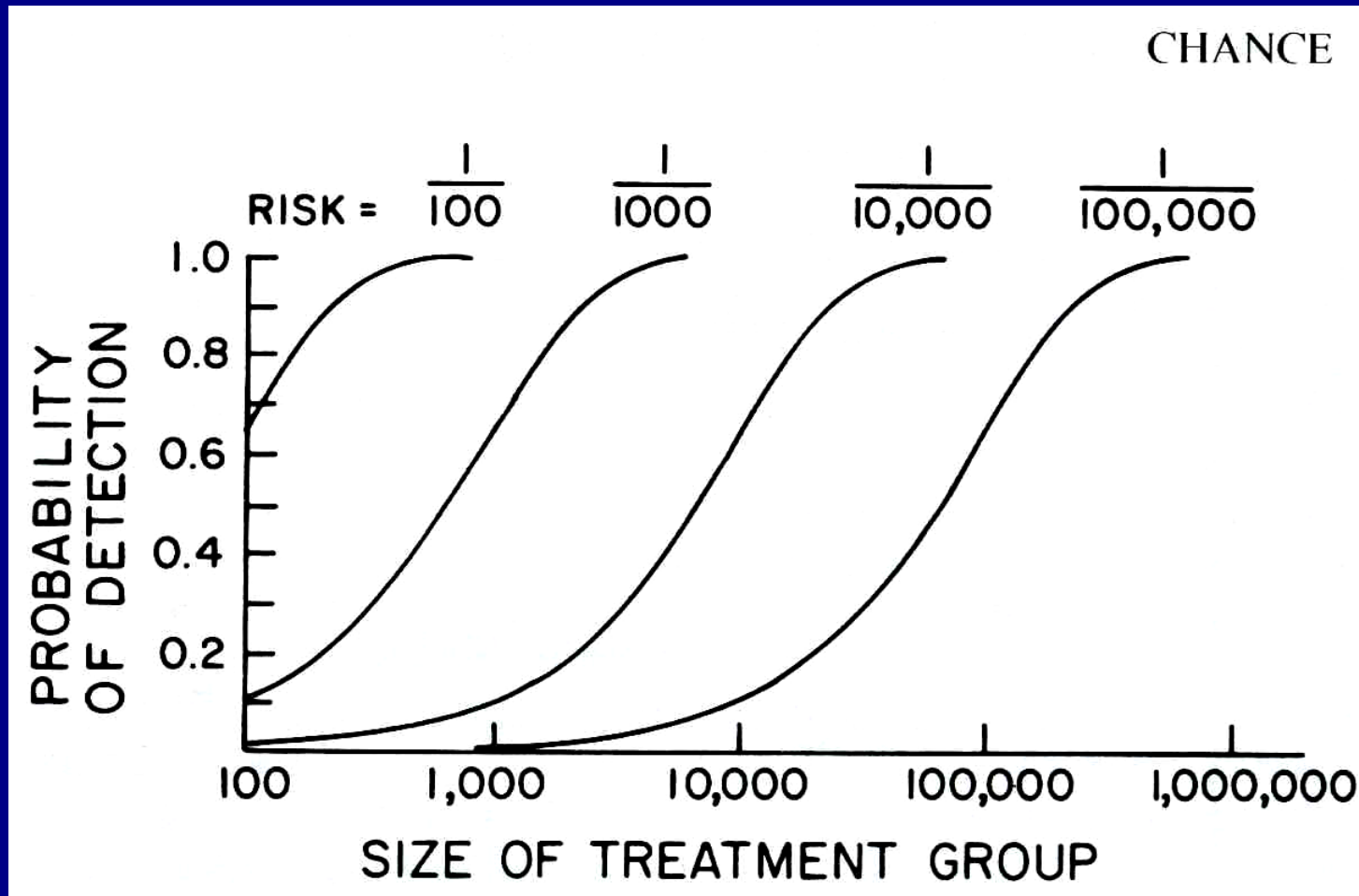
S = steady state adjustment factor

α = absorption (bioavailability) correction factor

Critical Effect

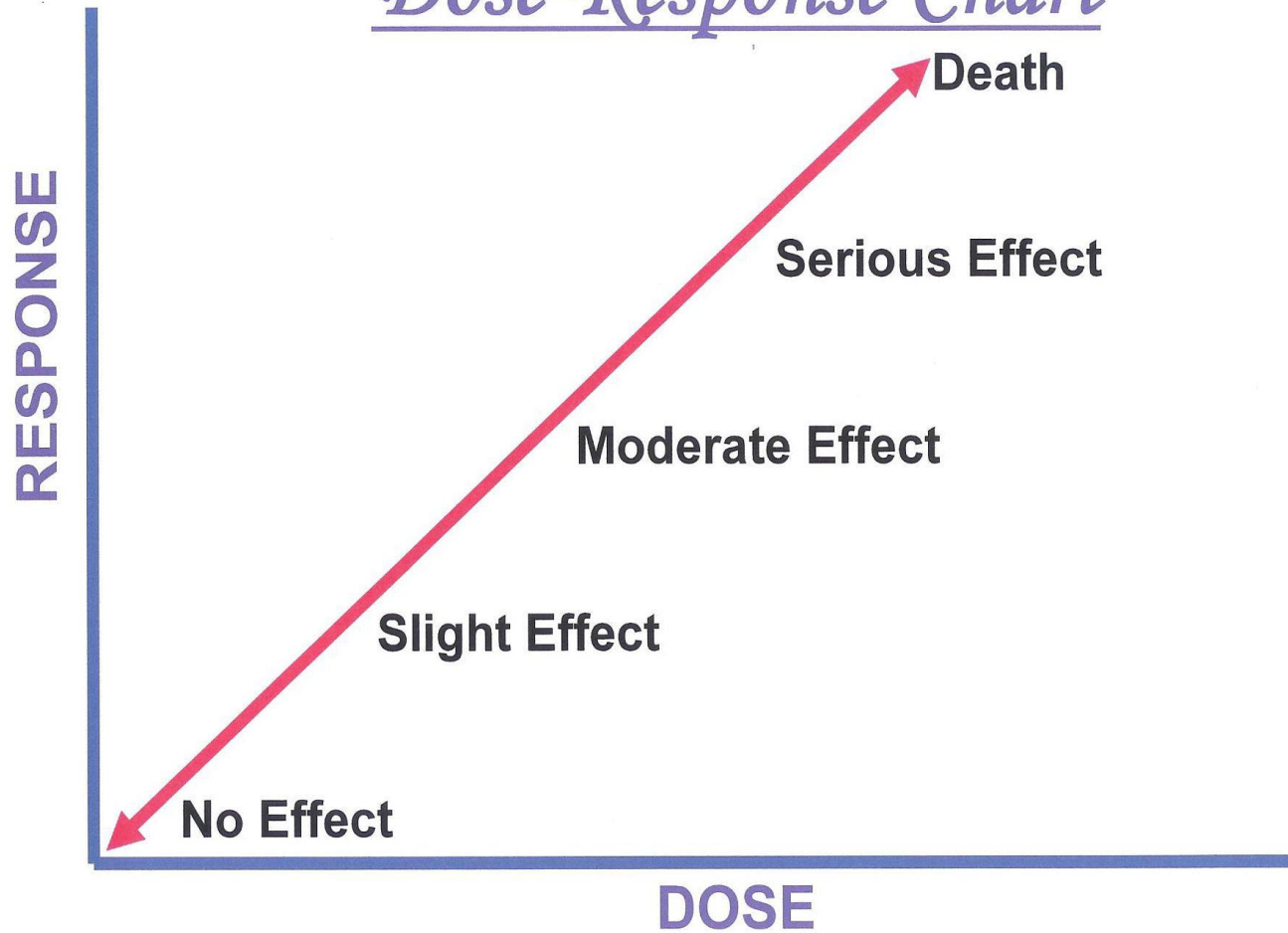


Can we really detect adverse effects?



Guess, HA, and SA Rudnick: Use of cost-effective analysis in planning cancer chemoprophylaxis. *Controlled Clin Trials* 4:89-100. 1983.

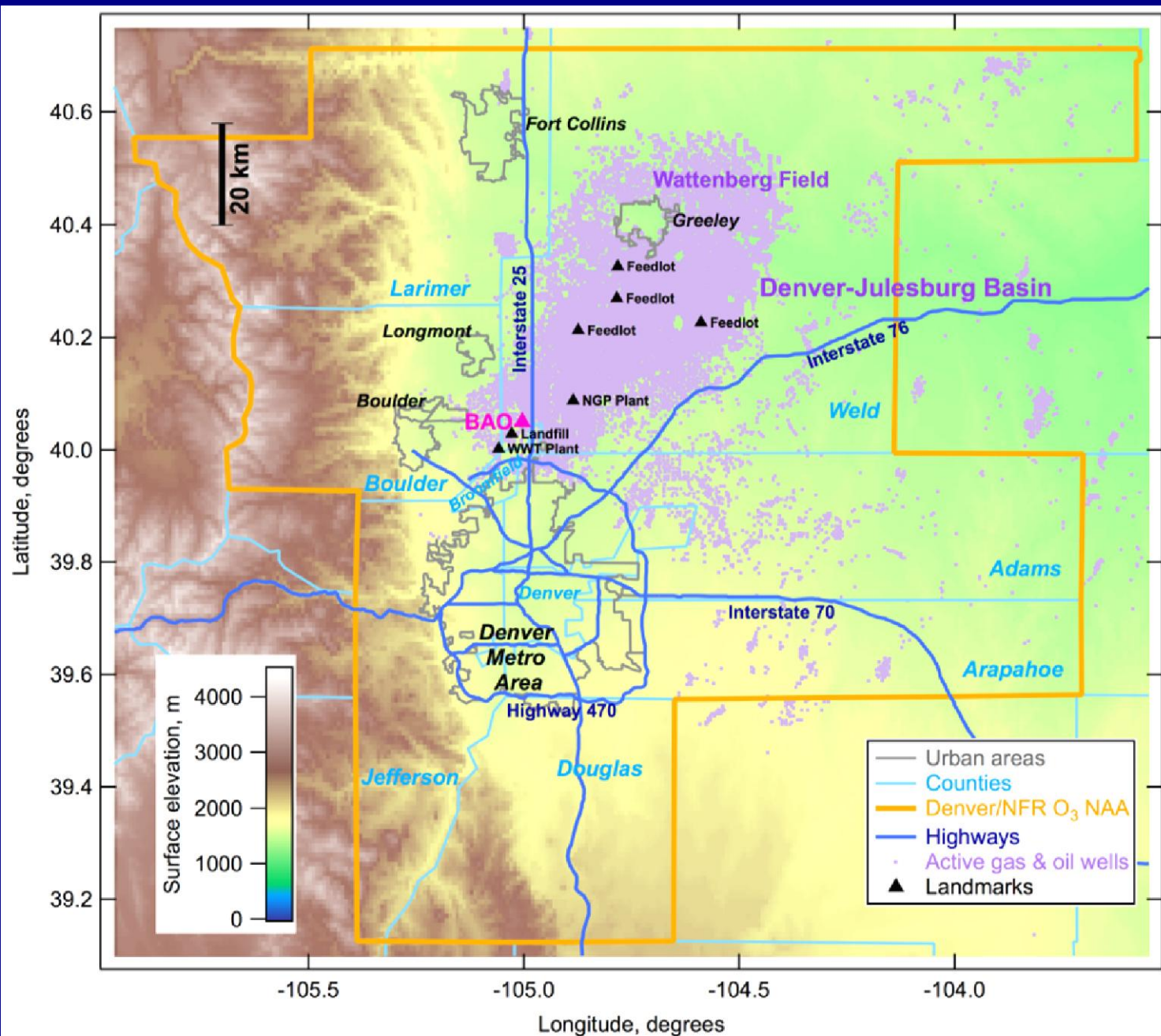
Dose-Response Chart



20 ppb vs. 17,000 ppb

**Where 17,000 ppb has a 560 to
2,800-fold safety factor already**





Safety Factor Info Part I

